

REPORT ON IRRIGATION

IN, THE

SHAHPURA CHIEFSHIP.

WITH

NOTE BY CONSULTING ENGINEER FOR IRRIGATION IN
RAJPUTANA.

1903.

AJMER :
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1903.

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NOTE.

For "STATE" throughout this Report, read
"CHIEFSHIP"

REPORT ON IRRIGATION IN THE SHAHPURA STATE.

1. The Shahpura State* is bounded on the north by Ajmer and Kishangarh, on the south and west by Mewar, and on the east by Mewar and Ajmer. Geographical Features.

2. It has an area of 405 square miles, the greatest length from north to south is 26 miles, and greatest breadth from west to east 21 miles.

3. The country is flat, averaging 1,200 feet above mean sea level; the only low hills are at Khamore, Dikola and Mindolia. The soil is mostly "Dhaminy," but between the Khari and Mansi rivers it is sandy, and towards the south it is black cotton soil.

4. The Khari River is on its north border, and the State is divided by—

- (a) The Mansi River,
- (b) The Thandal Nullah,
- (c) The Dikola Nullah,

which run from west to east through the State, the fall of the country averaging 6 feet per mile, following the course of the river. The State is therefore admirably situated naturally for irrigation.

5. The following are the areas of cultivated and uncultivated land; and proportion of each which is Khalsa :— Area.

	Area cultivated.	Uncultivated.	Total.
	1,58,373	1,00,828	2,59,201
Khalsa	90,971	53,966	1,44,937

The uncultivated area is all culturable if water for irrigation is available. 7

6. The population of the State according to the Census of 1901 is 43,000 as compared with 63,000, the figures of the 1891 Census; the decrease is due to the last famine, with its cholera epidemic, followed by fever. Population.

7. There are 210 villages in the State, of which 103 are Khalsa and 72 Jagir. Villages.

8. The average land revenue is about Rs. 1,35,000 (British coin). Land Revenue.

9. *Rainfall.*—The average rainfall is 24 inches. Rainfall.

10. *Means of Irrigation.*—There are 170 Tanks in the State, and Rs. 5,18,500 (British coin) has been spent on their construction. They are mostly small Tanks, with small catchments; and a few could Irrigation

*This refers to the Phulla Parganah. The Kachola Parganah, which is a Jagir in the Udaipur State, is not included in this Note.

be improved by supply cuts from Nullahs in the vicinity, for example the Tanks near Kaneshan could have their supply increased from the Gangli Nullah, and the Sangria Tanks from the Nagidia Nullah.

The majority of these Tanks have been made by the present Raja Dhiraj Sir Nahar Singhji, K.C.I.E., who is most anxious to carry out Protective Works, and to improve Irrigation in his State.

11. The land irrigated from these Tanks is estimated at 17 square miles, or 1,08,880 acres, or 1,74,080 bighas.

The Shahpura Bigha is $165 \times 165 = 27,225$ square feet, or 1.6 Bigha = 1 Acre.

12. The Revenue derived from Tank Irrigation is about Rs. 4,000 per annum, or a profit of $7\frac{3}{4}$ per cent. on the capital outlay.

Wells. 13. *Wells.*—There are altogether 6,655 wells in the State, both “kutchha” and “pucca.”

The average depth of water below the surface is 30 feet and the average cost of a well Rs. 150.

14. The area irrigated by these wells is estimated at 15,000 bighas or 14 square miles, so that on an average only two bighas are irrigated by one well.

Existing Irrigation arrangements. 15. The existing irrigation arrangements are insufficient to protect the State; the Tanks have only small catchment areas, and when the rainfall is deficient, fail. In the famine year of 1899-1900 they were all empty, and of no protective value whatever.

The water level of the wells is benefitted and dependent on the tanks above them in a great measure; as the tanks have failed, so the water level in the wells has fallen, and the area each can irrigate is reduced.

16. It is therefore proposed to take advantage of the Mansi River, and the Thandal and Dikola Nullahs, which run from east and west through the State.

These rivers have large catchment areas, mostly in ~~the~~ Udaipur State, and the water they discharge at present all runs to waste. By damming these rivers not far within the west limit of the State, and again lower down to store the surplus overflow water from the reservoirs above, it will be possible to utilise nearly all the water that passes through the State.

17. Protective Irrigation Works of great value will thus be constructed, which should also considerably increase the revenue of the State.

18. The Projects proposed (see Index Map attached) are:—

On the Mansi River—

(1) Storage reservoir at Arur.

(2) “ ” at Dhanop.

On the Thandal Nullah—

- (3) Storage reservoir at Soorajpura.
 (4) „ „ at Bhimpura.

On the Dikola Nullah—

- (5) Storage reservoir at Dikola.
 (6) „ „ at Baland.

19. Across the *Khari River* on the north border of the State, it would, I think, be possible to take a cut to divert some of the water down to Inria and Sangria. The *Khari River* from Taklan-ka-Khera to Arnia is divided into two streams, the right stream is narrow, with deep sandy banks, the left broad, with low banks.

By constructing a sand Bund across the right stream (No. 7 Index Map) at same point where the bed is say 10 feet below the level of the bed of the left stream at Taklan-ka-Khera, which would form our waste weir, we could take a cut, and probably divert a considerable amount of flood water down to Inria and Sangria, at comparatively little cost.

This is merely a suggestion as no surveys have been taken yet ; but they might be done later.

The Ajmer District is on the left bank of the river along this length, and their consent to the arrangement proposed would have to be obtained before it was actually carried out.

/ 20. There is also a very good site for a weir across the *Khari* below Phulia, about $\frac{3}{4}$ mile below the point where the *Mansi River* joins it. (No 8, Index Map.)

There is a rock bed all across the river, which is 650 feet broad at this point. Canals could no doubt be taken from this site to benefit Shahpura on the right bank and the Ajmer District on the left.

21. Taking the proposed works in detail.

Arur Project.—This was one of the three Projects in the Shahpura State, which was submitted to the Indian Irrigation Commission as worth further investigation, and detailed Surveys and Estimates for this have since been prepared, and await the Consulting Engineer's orders, after he has inspected the site, which is between the Arur and Dias villages, about three miles within the west boundary of the State.

**MANSI
RIVER.
Arur
Project.**

No Irrigation Works have up to the present time been constructed on the Mansi, so the full catchment area of 442 square miles is unintercepted.

**Catchment
Area.**

The river rises in the hills near Karera and flows for 60 miles through the Udaipur State, and the catchment is rocky at first and then hard soil ; and only at Arur itself becomes sandy ; so that we may calculate

**Nature of
Catchment.**

that 10 per cent. of the average rainfall of 24 inches will be available for storage on this large catchment, or 2,475 million cubic feet of water.

Capacity. The dam has, however, been designed with weir level at a height that the flood water will not submerge any of the land in ~~the~~ Udaipur State, and the tank will in consequence only have a capacity of 966 million cubic feet, so will fill if 4 per cent. of rainfall is stored.

Description of Dam. The dam which is nearly four miles in length, is designed with a face-wall of masonry backed with earth for a great portion of its length, and an earthen dam with front slope pitched for the remainder.

Weir. The top of the dam is eight feet above the weir level, and the weir which is at the north end is 2,850 r.ft. in length, calculated to discharge the maximum flood of 79,530 cubic feet per second, with a four foot head.

Area that can be irrigated. Allowing 1,00,000 cubic feet of water (this includes evaporation and absorption) per acre, 9,660 acres or 15,456 Shahpura bighas can be irrigated from the tank; and at Rs. two per bigha = Rs. 30,912
Deduct four annas per bigha for maintenance = - 3,864

Revenue derivable. Probable Revenue = Rs. 27,048 or 5½ per cent. on the estimated cost of the Project, Rs. 4,97,524.
Cost of Project.

If we add the revenue derived from cultivation of bed of tank, which will be made as the water recedes, this will give an addition of three square miles or 1,920 acres = 3,072 bighas at 2 per bigha = Rs. 6,144, making the total revenue derivable, Rs. 33,192 per annum, or over 6¼ per cent. profit on the Capital cost.

The lands of the following villages would be irrigated from the Tank.

In b.d, Rajas (J),* Sarsunda (J), Dias (J).

J Jaghir. Below Tank, Arur (K), Barla (J), Natrias (J), Panotia (K), Deoria
K-Khalsa (K), Choki (K), Hokanpura (K).

NIMBHERA PROJECT.

22. During my reconnaissance of the Mansi, I found a very good site for a storage reservoir higher up the river at Nimbhera in the Udaipur State, which may possibly be taken up at some future time.

The catchment area this would intercept from the Arur Project is about 135 square miles. It will be seen that this will not affect the Project as designed, as we should still have 307 miles of unintercepted catchment, or 1,719 m.c.ft. of water available for storage, and we only require 966 m.c.ft.

(See Appendix I. Inspection Note on the Arur Project by the Consulting Engineer for Irrigation.)

DHANOP PROJECT.

23. *Dhanop Project.*—On the principle that not a drop of water should be allowed to run to waste, there is a site for another Storage Reservoir on the Mansi about 5 miles below Arur, by connecting a series of sand hills (Tibas) between the villages of Gegua and Dhanop (See No. 2, Index Map.)

The unintercepted catchment area below Arur is 13 square miles of sandy soil, but the project is not dependent on this, but is proposed in order that the overflow from the Arur Tank passing down the Mansi may be diverted into an existing tank (The Dhirat Sagar), which was constructed in the famine and which will require raising.

The Dhirat Sagar has a very small catchment of its own and can never hope to fill at present; the bed is very sandy, and it is understood there is great loss by percolation of any water stored, but this would probably be lessened and eventually stopped altogether after the silt brought down by the Mansi was deposited on the bed.

It has been shown above that the Arur Project only requires 966 million cubic feet of the 2,475 m.c.ft. of the water available on its catchment, so that we have still 1,509 m.c.ft. of water running to waste, or should the Nimbhera Project in Mewar be carried out, we should have m.c.ft. of water available.

No detailed surveys have been taken, but from the levels taken we only store 510 m.c.ft. at Dhanop, as this is the capacity of the Tank in a natural weir on the south-west end above Gegua village, the over-water finding its way over this ridge into a nullah which joins the Mansi lower down.

This amount of water will be sufficient to irrigate 5,100 acres, or 60 bighas, or about 8 square miles.

This is a little more than our requirements, as the land commanded that lying between the Khari and the Mansi, which is about 7,000 has.

It is proposed to construct the dam, which is about $2\frac{1}{2}$ miles in length, entirely of earth, except for a portion 2,000 feet in length, where it crosses the Mansi, where a corewall would be provided.

The approximate estimated cost of the project is Rs. 1,00,000, and the probable revenue derivable would be Rs. 14,000, at Rs. 2 per bigha, or a profit of 14 per cent.

The land of the following villages would be irrigated from the tank: Dhanop (J), Chàran-ki-khera (J), Santokpura (J), Gegua (K), Ralaita (J), Rajpura (K), Phulia (K).

(See Appendix II — Inspection Note on Dhanop Project by the Consulting Engineer for Irrigation.)

24. *Soorajpura Project.*—This project was also submitted to the Irrigation Commission as worth investigation, and detailed plans and estimates have been prepared.

The site is at Soorajpura village about 3 miles within the west border of the State. The site is not a good one, as the land on either side the nullah is broken up a good deal, and the earth for the dam

THANDAL
NULLAH.
Soorajpura
Project.

is bad, gravel mixed with sand, but the Raja Dhiraj was anxious to store the water as near the border of the State as he could.

Catchment area. The drainage area of the nullah up to this point is 132 square miles all unintercepted; the country has a general fall of about 5 ft. per mile and is of hard soil.

Water available for storage. Allowing 10 per cent. of the average rainfall, we have 739 m.c.ft. as available for storage, but as in the Arur Project on the Mansi the weir level is fixed so that none of the Udaipur land shall be submerged, and **Capacity.** the capacity of the tank is 640 m.c.ft.

Description of dam. The dam, which is over $3\frac{1}{2}$ miles long, is designed with a facewall for 5,000 feet in length, where it crosses the nullah, and an earthen dam with front-slope pitched for the remainder.

Weir. The top of dam is 7 feet above weir level; the weir is at the north end; it is 1,150 r.ft. in length, to discharge the maximum discharge of the catchment of 32,010 c.ft. per second, with a 4 foot head.

Land that can be irrigated. The tank will irrigate 6,440 acres or 10,304 bighas, which at Re. (Rs. 2, less annas 4 maintenance charges) per bigha gives Rs. 18,03 the annual revenue. To this must be added about 2,560 acres or 4 per bighas in bed, giving Rs. 8,192 revenue @ Rs. 2 per bigha.

Revenue. The total revenue we can therefore estimate at Rs. 26,224, or a link, 8 per cent. profit on the estimated cost of the project, Rs. 3,32,146.

Villages benefited. The lands of the following villages would be irrigated from the tank: Soorajpura (J), Delas (K), Rupura (K), Thandal (J), Nimbhera

(See Appendix IV.—Inspection Note on Soorajpura Project by the Consulting Engineer for Irrigation.)

BHIMPURA PROJECT.

25. *Bhimpura Project.*—In making a reconnaissance of the nullah below Soorajpura, the State Overseer, Babu Ramchander, selected the site at Bhimpura as a suitable one for a storage reservoir. Bhimpura is 8 miles below Soorajpura, and the site selected is an excellent one in every way, with good "dhummy" earth for construction of the dam, and a wide basin, with an average fall of 5 feet per mile towards the embankment.

The dam would be in a straight line, crossing two nullahs, and can be extended on either side to store either—

- (a) The whole amount of water available on the whole catchment area of 184 square miles, on the supposition that the Soorajpura Project was not carried out.
- (b) The amount available from the overflow from Soorajpura and from the unintercepted catchment area of 52 square miles below.

In the first case we should have 1,073 m.c.ft. of water available for storage, allowing 10 per cent. of the average rainfall, and, from the preliminary surveys taken, to store 883 m.c.ft., the capacity of the tank

proposed, the dam would be 11,500 r.ft. or about $2\frac{1}{4}$ miles in length, and the weir level 30 feet above bed of the nullah. It is proposed to make the dam of earth, except for two lengths, each of 1,250 r.ft. where the Thandal and Geugli Nullahs are crossed, where corewalls and pitching to front slope are provided. The weirs will be natural weirs at either end, and the overflow water will spill over the land below. The approximate estimate of the project is Rs. 2,07,500, and the probable revenue derivable Rs. 34,256, being Rs. 2 per bigha on the 14,128 bighas (3,830 acres), which can be irrigated below the tank, and the 3,000 bighas (approximate) in bed, giving a profit of $16\frac{1}{2}$ per cent. on the capital cost.

In the second case the water available for storage would be 1,073 m. c.ft., less 640 required for Soorajpura and 20 m.c.ft. say for the Kanasan Tanks in the catchment, or 413 m.c.ft.

The weir level would be 26 feet above bed of nullah, and the length of dam 10,000 r.ft. or less than two miles. The approximate cost of the project is Rs. 1,50,250, and the probable revenue Rs. 17,216, viz., Rs. 2 on 6,608 bighas below and 2,000 bighas in the bed. This gives a profit of $11\frac{1}{2}$ per cent.

There is plenty of land below the site, and I understand the Raja Dhiraj wishes to make this tank in preference to the one at Soorajpura, as the land below is all Khalsa, and if the project is approved by the Consulting Engineer, the State Overseer will make out the detailed surveys, plans and estimates under my directions without delay.

(See Appendix III.—Inspection Note on the Bhimpura Project, by the Consulting Engineer for Irrigation.)

26. *Dikola Tank Project.*—This was the third project submitted to the Irrigation Commission as worth further investigation, and detailed plans and estimates have been prepared. The site is about 8 miles southwest of Shahpura, the dam following the natural ridge of low hills on which the Dikola Fort is built.

**DIKOLA
NULLAH**

Dikola
Project.

The catchment area of the Dikola Nullah at the site proposed is 85 square miles, the two branches of the nullah which rise in the hills near Banera in Mewar joining just above the Dikola Ridge.

Catchment
Area.

A weir was built many years ago across the north branch of the nullah, from which a feeder channel runs to one of the two existing tanks on the west of the Dikola Fort, but only a portion of the water which passes down this stream is caught, and all the water of the south stream runs at present to waste.

By continuing the dam proposed, all the water which is estimated as available for storage (allowing 10 per cent. of the average rainfall on the 85 square miles of catchment), or 470 m.c.ft. will be stored, and this will be sufficient to irrigate 4,700 acres, or 7,125 bighas—nearly 7 square miles of land below.

Capacity.
Area that
can be irrigated.

Land submerged.	The two existing tanks noted above, in the bed, will be submerged by the larger storage reservoir, and a portion of the catchment area of the tank below the Dikola Fort will also be intercepted, but this would be filled from the new tank, or if it was found cheaper the alignment could be altered to include this tank, the dam of which would have to be raised. 80 wells and 100 bighas of cultivated land will be submerged, and Rs. 36,000 has been provided in the estimate as compensation for this.
Description of Dam.	The dam, which is 14,610 r.ft. in length or 2 $\frac{3}{4}$ miles, follows the natural ridge, and would be entirely of earth on the north side of the Dikola Fort; for 4,000 r.ft. on the south of the Dikola Fort Hill earthwork with pitching to front slope is provided, and then earthwork with a corewall and pitching to front slope for 2,600 r.ft. in the centre portion, where the nullah is crossed, ending with earthwork and pitching for 2,500 r.ft., and plain earthwork for the last 2,250 r.ft. where the Naogam Hill is reached.
Weir.	The weir, which will be 1,500 r.ft. in length, will discharge the maximum discharge of 23,100 c.ft. per second, with 3 ft. head, and will be a natural weir west of the Naogam Hill, the waste water discharging into a branch nullah on the south of the hill, which is in the Mewar State .
	This branch nullah joins the Dikola Nullah lower down in the Shahpura State, and it is proposed to store the water it brings down in the rains, as well as any overflow from this Dikola Tank, lower down at Baland.
Revenue.	The revenue may be calculated as—below tank 4,700 acres = 7,520 bighas @ Re. 1-12 = Rs. 13,160; in bed 1,920 acres = 3,072 bighas @ Rs. 2 = Rs. 6,144; total Rs. 19,304, or 8 per cent. profit on the estimated cost, Rs. 2,38,924, which includes Rs. 36,000 compensation for wells and cultivated land submerged.
Villages benefited.	The land of the following villages will be irrigated from the tank: Dikola (K), Naogang (J), Kui (K), Khera (K), and Ragunathpura (K).
	<u>(See Appendix V.—Inspection Note on the Dikola Project, by the Consulting Engineer for Irrigation.)</u>
Baland Project	27. <i>Baland Project.</i> —A nullah, which rises in the hills near Lampa in Mewar and flows through that State for about 15 miles, joins the Dikola Nullah in Shahpura, just east of Naogam, passing at the south end of the proposed Dikola Tank, and it is this nullah into which the overflow from the Dikola Tank will pass.
	The State Overseer was directed to inspect the nullah below Dikola, to prospect for a site where the water of this extra nullah and the overflow from Dikola (if any) could be stored and used with advantage to the Shahpura State. The site selected was at Baland, 13 miles east of Dikola, and the total catchment area up to this point is 189 square miles,
	The catchment area is rocky at first, and then black soil, and allowing

10 per cent. of the average rainfall as available for storage, and making allowance for certain small existing tanks in the catchment below Dikola, we shall still have 550 m.c.ft. of water available at Baland.

No detailed surveys have been made at present, and the line, as finally fixed, will start near Baland village on the south, cross the nullah about 300 ft. below Rampura (deserted) village, and extend till the high ground on the north is reached; and will be about 1,320 r.ft. in length, or $2\frac{1}{2}$ miles.

The soil is bad for an earthen dam, consisting of gravel mixed with sand, and a corewall will be required throughout.

The weir, which will have to be 650 r.ft. in length, will probably be at the north end, and the weir level will be 30 feet above the bed of nullah.

The approximate estimate of the cost of the project is Rs. 1,70,000, and the probable revenue derivable—

In rear 5,000 acres (area that can be irrigated)	Rs. .
= 8,000 bighas at Rs. 2 per bigha ...	= 16,000
Bed 1,600 acres (approximate) = 2,560	
bighas at Rs. 2 per bigha ...	= 5,120
	<hr/>
Total ...	21,120

or nearly $12\frac{1}{2}$ per cent. profit on the capital cost.

See Appendix VI.—Inspection Note on Baland Project, by the Consulting Engineer for Irrigation.

28. The projects proposed are all of a large order, but it is only by attacking the large rivers, with large catchments, that protection can be afforded.

Though the cost of carrying out any one would be great for a small State like Shahpura, provided all the water stored can be made use of, the money would be well and profitably spent.

The works would of course be taken up gradually one by one, and when eventually completed, it is thought that all that is possible would have been done, and every advantage taken to make use of the water that passes through the State, and very little would have been allowed to run to waste.

F. ST.-G. MANNERS SMITH,

SUPERINTENDING ENGINEER,

Protective Irrigation Works, Rajputana

NOTE BY THE CONSULTING ENGINEER
FOR
IRRIGATION IN RAJPUTANA
ON
PROPOSALS IN THE STATE OF SHAHPURA.
MARCH, 1903.